

Report as of FY2011 for 2011GU194B: "Comprehensive Analysis of Salinity Trends in Northern Guam Lens Aquifer"

Publications

- Dissertations:
 - ◆ Simard, Christine A., 2012, Salinity Trends in the Northern Guam Lens Aquifer, M.S. Thesis, Graduate Environmental Science Program, College of Natural and Applied Sciences, University of Guam, Mangilao, Guam, 281 pp.

Report Follows

PROJECT SYNOPSIS REPORT

Project Title: Comprehensive Analysis of Salinity Trends in the Northern Guam Lens Aquifer

Problem and Research Objectives

The Northern Guam Lens Aquifer (NGLA) provides 80% of Guam's drinking water. Current withdrawal by all producers is about 45 million gallons per day (mgd), against a currently estimated sustainable yield of about 80 mgd. The anticipated addition of new US Marine Corps facilities during the next decade is expected to require an additional 5-6 mgd to support the new military activities alone, and additional economic growth on the island will certainly further increase demand for municipal and private production as well. There is thus a compelling need for a new survey, building on historical knowledge, to: (1) Precisely identify and analyze the current trends in salinity in Guam's aquifer and drinking water production wells during the past decade, (2) Investigate the possible causes of the trends, and (3) Recommend appropriate responses to documented trends to promote sustainable development of additional capacity.

Methodology

The proposed project compiled and evaluated historical and current WERI/USGS data collected through the CWMP, along with GWA data on production rates and chloride concentrations. Spatial relationships and trends were identified and evaluated to determine not only the current distribution of relatively low- and high-chloride zones in the aquifer, but also the historical spatial and temporal trends in the relationships between chloride concentrations in Guam's freshwater lens and production wells on the one hand, and spatial and historical trends in production rates and recharge on the other hand.

Principal Findings and Significance

This two-year study of the 39-year records of salinity and groundwater management data from production and observation wells on northern Guam has shown (1) significant increasing groundwater chloride trends at about three-fourths of the production wells, (2) correlations with local precipitation and mean sea-level trends, (3) thinning of the freshwater lens by 2 to 16 meters between 2005 and 2009, (4) seasonal fresh water lens fluctuations of up to 70 meters in the Hagatña Sub-basin between 2005 and 2009, and (5) increasing chloride trends in the supra-basal groundwater zone—which indicates meteoric and/or man-made chloride sources other than over-pumped or over-deep wells. Key recommendations include: (1) installation of additional observation wells across the aquifer, (2) use of dedicated conductivity, temperature, depth (CTD) probes to continuously monitor salinity fluctuations and freshwater lens thickness, (3) studies of candidate natural and man-made sources of chloride in recharging waters, and (4) well-design guidelines for production wells in supra-basal zones and near the saltwater toe of the lens.